

REMARKS

Summary

The Examiner's analysis and the references cited in the Office action have been carefully considered. Claims 1-16 were pending. Claims 10-16 have been allowed; Claims 1-9 were rejected. New Claims 17-27 have been added. No new matter has been added as a result of this amendment. Claim 1 has been amended to more clearly define the invention to which the claim is directed. Figs. 9A and 9B have been redrawn and Fig. 7 has been amended. Claims 1-27 are now pending.

Objection to Figures

In the Office action, the Examiner objected to the drawings under 37 CFR § 1.83(a) as not showing several features. Figs. 9A and 9B have been redrawn in response to the Examiner's objections. The amended drawings illustrate the geometry of the situation such that it is clear that the radius of the peripheral curved surface is smaller than the second radius of the bottom curved surface as required by the Examiner. This comports with the written description found on page 26, lines 4 through 17, of the specification. The normal lines L_1 and L_2 are perpendicular to the reflector surface. This may be seen by comparison with Fig. 16 which is a view of an example reflector and illustrates such a normal line H. Fig. 9B is amended to designate the centers of the projected views of the two curved surfaces as O_3 and O_4 in order to differentiate them from the centers of the spheres of radius R_1 and R_2 .

Although not objected to by the Examiner, Fig. 7 has been amended to add a designation β to the dashed curve. As such, it is consistent with both Fig. 12 and with the specification, page 3 lines 21 through 24, which cites this curve in both Figs. 7 and 12 in describing the prior art.

Copies of the drawings with the changes marked in red ink are appended to this response. The Examiner is respectfully requested to review these drawing changes and approve the corrections in the next office action.

Rejection of Claims

Applicants respectfully request reconsideration in view of the amendments above and the remarks to follow. It is respectfully submitted that Claims 1-9 and new Claims 17-25, are in condition for allowance.

Rejections under 35 U.S.C. § 112, second paragraph

Claims 1-9 have been rejected under 35 U.S.C. §112, second paragraph as being indefinite. Applicants have amended Claim 1 to more clearly recite the conditions under which the inclination angle can be considered to have reached a maximum. On page 8 lines 9 through 11, the specification discloses one range of maximum values which could be obtained, providing a clear definition of the range. Since only one maximum value of inclination angle can be found in any light-reflecting concave portions, this is not indefinite; it is merely that the maximum value occurs in a manner which is not completely symmetric, thus differentiating it from the prior art where the maximum angle in a spherical surface is symmetric with respect to a radius of the spherical section which is orthogonal to the reflector surface. Applicants submit that Amended Claim 1 overcomes the rejection. Claims 2-6 and Claim 8 are dependent from Claim 1, and have not been otherwise rejected.

Claim 9 has been amended to clarify the position of the observer with respect to the reflector and the incident light. Both of these concepts may be understood by reference to Figure 18, which illustrates the observer viewpoint with respect to the illumination incident on the reflector. Support for the amended claim may be found, *inter alia*, on page 5 lines 9 through 26. Claim 9 is now also in definite form. Applicants submit that amended Claim 9 overcomes the rejection

Rejections under 35 U.S.C. § 102(a)

The Examiner has rejected Claims 1-6 and 8 under 35 U.S.C §102(a) as being anticipated by prior art described in the specification (Fig. 15, page 2 line 2 to page 3 line 3). On page 2, lines 10 through 15, Applicant describes the prior art as being comprised of concave portions...."each being part of a sphere....". Subsequently on page 3, lines 21 through 24, the light reflectance characteristics of this prior art are described with reference to Fig. 7, shown as a dashed line, where it is distinguished from the light reflectance distribution of the concave portions with multiple radii of curvature characteristic of the arrangement recited in Claim 1.

This prior art, however, does not disclose or suggest the arrangement of Claim 1. Amended Claim 1 recites a reflector having, *inter alia*, "concave portions wherein an inclination angle (an absolute value of an angle between a plane tangential to a point on the concave surface of the base material) is maximized on a side portion of said curved portion." This defines a structure different from a spherical curved surface as was described in Applicants' specification as Background, and relied on by the Examiner. The inclination angle of a curved surface which is a section of a sphere would be symmetrical and would reach its maximum at all azimuths of the intersection of the curved surface with the base layer, and thus not meet the limitation recited.

Applicants respectfully traverse the Examiner's rejection of these claims under 35 U.S.C §102(a).

Rejections under 35 U.S.C. § 102(e)

The Examiner further rejects Claims 1 and 7-9 under U.S.C. §102(e) as being anticipated by Akins et al. (US6285425B1). Applicants respectfully traverse this rejection.

Amended Claim 1 recites a plurality of curved surfaces, enabling reflector designs with control of the angular distribution of reflection intensity in longitudinal and transverse angular space, permitting control of the intensity distribution in two angular dimensions.

Amended Claim 9 recites "...side portions ...aligned in a certain direction...having the maximum inclination angle...on a side opposing the viewpoint of the observer." The '425 patent, on the other hand, does not disclose anything about the relationship between the reflecting surface and a reflectance peak or the relationship between the reflector and a viewpoint of an observer.

The object of the '425 patent is to cause the angle of reflection of the external illumination to differ from that of the angle of incidence, to avoid the glare resulting from specular reflection at various surfaces of the device. The approach is that of a tilted ridged mirror structure, having one or two dimensional periodic properties. While the reflected angular distribution of the light will maximize at a different angle with respect to the normal from which it was incident, the angular distribution of the light will be little varied from that of the illuminating source, which may be quite narrow; it would not be modified in angular distribution as is achieved in the present invention. Modification of the exit intensity spectrum in the '425 patent requires the use of a separate diffusive layer within the device or, alternatively, roughening the surface of the reflector in a separate manufacturing operation.

In addition, the use of periodic structures for the reflection as taught by Atkins, in conjunction with the periodic structure of the liquid crystal element will result in a moiré pattern, which can be distracting to the user. This problem is intrinsic to all of the art disclosed in '425. A specific object of the arrangement recited in Claim 9 is to avoid the type of structural periodicities which would result in moiré patterns.

For the reasons set forth above, applicants respectfully traverse the Examiner's rejection of Claims 1 and 7-9 on the basis of 35 U.S.C. §102(e).

New Claims 17-25 recite arrangements in which the inclination angles of curved portions are maximized on a side portion, and which specify shapes of curved portions to achieve the advantages described above. None of the cited references anticipate or disclose the arrangements recited in these claims.

New Claims 26 and 27 recite an arrangement of a liquid crystal display incorporating the reflection element where the desired diffusive effect may be

achieved without a separately applied diffusing layer, unlike the art cited by the Examiner. Such a separately applied diffusing layer may introduce additional optical transmission loss, which may be strongly angularly dependent, on both the inward and outward passage of the light, thus reducing the reflected light intensity; and it may also have the effect of increasing the brightness of the display surface, with concomitant reduction in the contrast ratio of the display.

For at least these independent reasons, new Claims 18-27 are patentable over the references cited.

Conclusion

Claims 10-16 have been allowed.

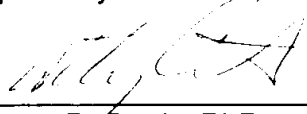
The Examiner's objections to the drawings have been addressed in this amendment, and it is respectfully submitted that the rejections to Claims 1-9 have been overcome by amendments made and the arguments presented above, and should now be allowed.

Applicants present new claims 17-27 for consideration. These claims are supported by the specification and further define the invention in a scope to which the applicants are clearly entitled.

Attached hereto is a marked-up version of the changes made to the claims by the current amendment. The attached page is Appendix A. The drawings with changes marked in red are appended.

Applicants respectfully request that a timely Notice of Allowance be issued in this case.

Respectfully submitted,



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Appendix A

VERSION WITH MARKINGS TO SHOW CHANGES MADE

1. (Amended) A reflector, comprising a plurality of light-reflective concave portions formed on a surface of a base material, each of the concave portions being a concave surface and being formed so that an inclination angle (an absolute value of an angle between a plane tangential to a point on the concave surface and the surface of the base material) is maximized ~~maximum~~ on a side portion of ~~the~~said concave portion ~~curved surface~~.

9. (Amended) The reflection type liquid crystal display device according to claim 8, wherein the reflector is formed so that the side portion having the maximum inclination angle of the concave surface of each of the plurality of the concave portions is aligned in a certain direction and is mounted so that the side portion having the maximum inclination angle of the concave surface of each of the plurality of the concave portions is ~~aligned to be on a far side from a~~ disposed on a side opposing a viewpoint of an observer.